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The following claim amendments were submitted with the Preliminary Amendment of November 3, 2004 and are included here as a matter of convenience.

Amendments to the Claims

1. (Cancel) An apparatus for the monitoring and control of the combustion process in combustion zone of a burner assembly of a combustion system, the apparatus comprising:
a combustion system comprising a fuel nozzle having a first and second end and an outer shell in fluid communication with the fuel nozzle second end, wherein the outer shell defines a combustion chamber;
a means for supplying a hydrocarbon-based fuel to the fuel nozzle at a rate;
a means for supplying an oxidizer to the fuel nozzle at a rate;
a means for igniting the hydrocarbon-based fuel and oxidizer thereby initiating the combustion process, the products of which comprises hydrocarbon ions;
a sensor positioned within the combustion system, said sensor including a first electrode and a second electrode in spaced-apart relationship of the first electrode, wherein at least a portion of the combustion process takes place between the first and second electrodes;
a means for applying a voltage between the first and second electrodes; and
a means for determining the magnitude of a current between the first and second electrodes.

17. (New -Replaces Cancelled Claim 1) An apparatus for the real-time monitoring and control of the combustion process in the combustion zone of a burner assembly of a combustion system, the apparatus comprising:
flow-through combustion means having upstream and downstream end portions in fluid communication;

said upstream end portion having at least one fuel mixing chamber including fuel supplying means for supplying a hydrocarbon fuel at a first rate and oxidizer supplying

means for supplying an oxidizer at a second rate in flow-through communication with said downstream end portion;

combustion means disposed in said downstream end portions including an outer shell having a fuel nozzle, having upstream and downstream portions, disposed therein downstream from and in flow-through communication with said fuel mixing chamber;

a means for initiating the combustion process with the hydrocarbon fuel and oxidizer to maintain a combustion flame plume during operation of the combustion burner assembly, wherein the products of combustion include hydrocarbon ions;

a sensor positioned within the combustion means, said sensor including a first electrode and a second electrode in axially spaced-apart relation to provide for flame plume, wherein a portion of the flame plume is disposed between the first and second electrodes;

means for applying a predetermined voltage between the first and second electrodes; and

means for determining the magnitude of the current between first and second electrodes to selectively measure the concentration of hydrocarbon ions in said flame plume.

2. (Currently Amended) The apparatus of claim ~~1~~17 wherein ~~the~~ said sensor first electrode is centered in the fuel nozzle adjacent to the second end.

3. (Currently Amended) The apparatus of claim ~~1~~ 17, wherein the second electrode is radially outward of the first electrode.

4. (Currently Amended) The apparatus of claim 3, wherein the sensor second electrode is part of the outer shell and the outer shell is electrically insulated from the ~~second end~~ downstream portion of the nozzle.

5. (Currently Amended) The apparatus for the monitoring and control of the combustion process of claim ~~4~~ 17, wherein the nozzle is a lean premix fuel combustion nozzle.

6. (Currently Amended) The apparatus of claim ~~4~~ 17, wherein said first and second electrodes are spaced apart and insulated by a ceramic material.

7. (Currently Amended) The apparatus of claim ~~4~~ 17, wherein said ~~a~~ fuel supplying means means for supplying a hydrocarbon-based fuel to the fuel nozzle at a first rate that is electronically coupled to said means to determine the magnitude of the current between the first and second electrodes.

8. (Currently Amended) The apparatus of claim ~~4~~ 17 wherein the first and second electrodes are located within the combustion chamber.

9. (Currently amended) The apparatus of claim ~~4~~ 17 wherein the rate of supply of the hydrocarbon-based fuel to the nozzle and the rate of supply of oxidizer to the nozzle is maintained at about a constant level, wherein a decrease in the magnitude of the current indicates the movement of the combustion process away from the first electrode.

10. (Currently Amended) The apparatus of claim ~~4~~ 17, wherein the change in the magnitude of the current is proportional to the change in the amount of hydrocarbon ions in the combustion process.

11. (Cancelled)

18. (New- Replaces Cancelled Claim 11) A apparatus for the real-time monitoring and control of the combustion process in combustion zone of a lean premix burner of a combustion system, the system comprising:

5 flow-through combustion means having upstream and downstream end portions in fluid communication;

said upstream end portion having at least one fuel mixing chamber including fuel supplying means for supplying a hydrocarbon fuel at a first rate and oxidizer supplying means for supplying an oxidizer at a second rate in flow-through communication with said downstream end portion;

combustion means disposed in said downstream end portions including an outer shell having a lean premix fuel nozzle, having upstream and downstream portions, disposed therein downstream from and in flow-through communication with said fuel mixing chamber and a center body surrounded by the nozzle;

a means for initiating the combustion process of the hydrocarbon fuel and oxidizer to maintain a combustion flame plume during operation of the combustion burner assembly, wherein the products of combustion include hydrocarbon ions;

a sensor positioned within the combustion means, said sensor including a first electrode and a second electrode in axially spaced-apart relation to provide for flame plume, wherein a portion of the flame plume is disposed between the first and second electrodes, wherein said sensor first electrode is centered in the lean premix nozzle center body;

means for applying a voltage between the first and second electrodes; and

means for determining the magnitude of the current between said first and second electrodes to selectively measure the concentration of hydrocarbon ions in said flame plume.

12. (Cancelled) An apparatus for the monitoring and control of the combustion process in the combustion zone of the burner of a combustion system, the apparatus comprising:

a combustion system comprising a fuel nozzle having a first and second end and an outer shell in fluid communication with the fuel nozzle second end, wherein the outer shell defines

a combustion chamber;

a means for supplying a hydrocarbon-based fuel to the fuel nozzle at a rate;
a means for supplying an oxidizer to the fuel nozzle at a rate;
a means for igniting the hydrocarbon-based fuel and oxidizer thereby initiating the combustion process, the products of which comprises hydrocarbon ions;

a sensor positioned within the combustion system, said sensor including a first electrode and a second electrode in spaced-apart relationship of the first electrode, wherein at least a portion of the combustion process takes place between the first and second electrodes;

a means for applying a voltage between the first and second electrodes;
and a means for determining the change in magnitude of a current between the first and second electrodes.

13. (Currently Amended) The apparatus of claim ~~12~~ 18 wherein the change in magnitude of the current between the first and second electrode identifies the presence of a flame.

14. (Currently amended) A process for monitoring and control of the combustion process in combustion zone of a lean premix burner of a combustion system, the process comprising:

providing a combustion system comprising a fuel nozzle having a fuel inlet, a gas inlet, and an outer shell, wherein at a portion of the outer shell defines a combustion zone and a sensor positioned within the combustion system, said sensor including a first electrode and a second electrode in spaced-apart relationship of the first electrode,

supplying a hydrocarbon-based fuel to the fuel nozzle at a first rate;

supplying an oxidizer to the fuel nozzle at a second rate;

mixing the fuel and the oxidizer;

igniting the hydrocarbon-based fuel-oxidizer mixture such that the combustion process proceeds, wherein at least a portion of the combustion process takes place between the first and second electrodes;

applying a voltage between the first and second electrodes; and

measuring the magnitude of a current between the first and second electrodes.

15. (Original) The process of claim 14 wherein the first rate at which the fuel is supplied is adjusted to maintain the magnitude of the current between the first and second electrode at about a constant level.

16. (Original) The process of claim 14 wherein the second rate at which the oxidizer is supplied is adjusted to maintain the current between the first and second electrode at about a constant level.

19. (New) A process for monitoring and control of the combustion process in combustion zone of a lean premix burner of a combustion system, the process comprising:

providing a combustion system comprising a fuel nozzle having a fuel inlet, a gas inlet, and an outer shell, wherein at a portion of the outer shell defines a combustion zone and a sensor positioned within the combustion system, said sensor including a first electrode and a second electrode in spaced-apart relationship of the first electrode,

supplying a hydrocarbon-based fuel to the fuel nozzle at a first rate;

supplying an oxidizer to the fuel nozzle at a second rate;

mixing the fuel and the oxidizer;

igniting the hydrocarbon-based fuel-oxidizer mixture such that the combustion process proceeds, wherein at least a portion of the combustion process takes place between the first and second electrodes;

applying a voltage between the first and second electrodes; and

measuring the magnitude of a current between the first and second electrodes

wherein the second rate at which the oxidizer is supplied is adjusted to maintain the current between the first and second electrode at about a constant level.